the legitimate needs of LMS multilateration and non-multilateration providers.

Respectfully submitted,

BAY STATE GAS COMPANY[28/]
THE BERKSHIRE GAS COMPANY
BLACKSTONE GAS COMPANY
BOSTON GAS COMPANY
BRISTOL AND WARREN GAS COMPANY
CITY OF WESTFIELD GAS AND ELECTRIC LIGHT DEPARTMENT
CITY OF HOLYOKE, MASSACHUSETTS GAS AND ELECTRIC DEPARTMENT
COLONIAL GAS COMPANY
COMMONWEALTH GAS COMPANY
CONNECTICUT NATURAL GAS CORP.
ENERGYNORTH NATURAL GAS, INC.
ESSEX COUNTY GAS COMPANY
FALL RIVER GAS COMPANY
FITCHBURG GAS AND ELECTRIC LIGHT COMPANY
NORTHERN UTILITIES, INC.
THE PEOPLES GAS LIGHT AND COKE COMPANY
SOUTHERN CALIFORNIA GAS COMPANY
THE PROVIDENCE GAS COMPANY
THE SOUTHERN CONNECTICUT GAS COMPANY
VALLEY GAS COMPANY
VERMONT GAS SYSTEMS
WAKEFIELD MUNICIPAL LIGHT DEPARTMENT
WASHINGTON GAS LIGHT COMPANY
YANKEE GAS SERVICE COMPANY

By: ______________________
George L. Lyon, Jr.
Their Counsel

Lukas, McGowan, Nace & Gutierrez, Chartered
1111 19th Street, N.W. Suite 1200
Washington, DC 20036
(202) 857-3500

April 24, 1995

[28/] As of the filing of this Petition, the listing of the utilities joining herein is incomplete. A full listing of utilities joining herein will be submitted shortly.

EXHIBIT I

Affidavit of Thomas G. Adcock

AFFIDAVIT

City of Washington :

: SS

District of Columbia :

I, THOMAS G. ADCOCK, P.E., having been first duly sworn, depose and state as follows:

1. I am a registered Professional Engineer in Washington, D.C. and the Director of Engineering for the firm of Lukas, McGowan, Nace and Gutierrez, Chartered.

2. I graduated from the United States Military Academy at West Point, New York in 1957 with a Bachelor of Science degree, and from the Massachusetts Institute of Technology, Cambridge, Massachusetts in 1963 with a degree of Masters of Science in Electrical Engineering. In addition, I have completed post-masters degree courses at New York University and George Washington University, and am a Senior Member of the Institute of Electrical and Electronic Engineers.

3. I am familiar with the Federal Communications Commission's ("FCC's") rules including Part 15, and since 1982 have prepared or supervised the preparation of the technical portions of hundreds of applications, engineering statements and other submissions filed with the FCC.

4. On behalf of an ad hoc coalition of natural gas distribution utilities ("Gas Utilities"), I have reviewed the Commission's February 6, 1995 Report and Order establishing rules for services and equipment using the 902-928 MHz band including the establishment of the Location and Monitoring Service ("LMS").

5. The proposed rules permit LMS systems to operate co-channel with the automatic meter reader ("AMR") Part 15 equipment used by the Gas Utilities in the 909.75-919.75 MHz sub-band. Under the proposed rules, these co-channel LMS operations would be authorized with a maximum effective radiated power ("ERP") of 30 Watts and a maximum antenna height of 15 meters above the ground

level ("AGL"). These LMS operations would be limited to a maximum bandwidth of 12 MHz, but no minimum bandwidth would be imposed by the proposed rules.

6. The mobile AMR transmitters used by the Gas Utilities frequency hop across an 8 MHz bandwidth in the 902-928 MHz band. The AMR receivers use a 200 kHz intermediate frequency ("IF") bandwidth.

7. Enclosed as Exhibit 1 are calculations estimating the maximum distance over which a 30 Watt co-channel LMS station could cause harmful interference to an AMR mobile receiver. These calculations show that interference is possible, even where the mobile receiver is more than a mile away from the co-channel station.

8. However, if the LMS co-channel station's maximum ERP were reduced to 10 Watts, then the maximum distance for harmful interference to an AMR mobile receiver would be reduced to less than a mile.

9. These harmful interference distances can be converted into areas of interference. At 30 Watts, a co-channel station could interfere over an area of 4.45 square miles ($1.19^2\pi$), while at 10 Watts the interference area would be reduced to only 2.43 square miles ($0.88^2\pi$). Hence, reducing the ERP to 10 Watts reduces the area of possible interference by a factor of 1.83 (4.45/2.43).

10. Moreover, if both ERP and height were limited to 10 Watts and 10 meters respectively, the maximum interference distance would be reduced to about three-quarters of a mile and the interference area would be only 1.79 square miles ($0.756^2\pi$), a reduction by a factor of 2.49 (4.45/1.79).

11. Other Part 15 devices would experience similar improvements in interference from a reduction of ERP to 10 Watts.

12. The proposed LMS rules would allow multilateration systems to operate narrowband forward links with up to 300 Watts ERP without any height above average terrain limitation. At substantial HAATs, 300 Watts can be equivalent to much higher

powers. For example, the FCC Part 22 rules for regulating cellular two-way mobile communications in the 800-900 MHz spectrum are based on a formula used to determine the distance to a 32 dBuV/m (-102 dBm) signal level. Using this formula for 300 Watts at 1,000 meters height above average terrain ("HAAT") results in a distance of 69.9 km (43.4 miles) to the 32 dBuV/m contour. Were the HAAT to be reduced to only 100 meters, it would require an ERP of 30,005 Watts to produce a 32 dBuV/ contour at 69.9 km using the FCC's formula.

13. I have reviewed the petition to which this affidavit is attached, and have determined that the technical statements contained therein are accurate.

14. The foregoing statements of fact are true and correct to the best of my own personal knowledge and belief, and are proffered in good faith.

Thomas G. Adcock

THOMAS G. ADCOCK, P.E.

Subscribed to and sworn to before me
this 24th day of April, 1995.

R. Loren Bradon

Notary Public

My commission expires:

R. LOREN BRADON
NOTARY PUBLIC DISTRICT OF COLUMBIA
My Commission Expires October 31, 1997

DISTRICT OF COLUMBIA

Co-Channel Interference Analysis for AMR Van Mounted Mobile Receiver from a 30 Watt Co-Channel LMS Transmitter

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1. Hata Propagation Loss Model (taken from p. 87 of IEEE Transactions on Vehicular Technology, May 1985)

$$L = 69.55 + 26.16 \log f - 13.82 \log h_b + (44.9 - 6.55 \log h_b) \log R - A_{hm}$$

For medium-small city environment:

$$A_{hm} = (1.1 \log f - 0.7)\, h_m - (1.56 \log f - 0.8)$$

Where:
L = loss in dB
f = frequency in MHz
h_b, h_m = base, mobile station antenna height in meters
R = distance in km between antennas

Using:
$f = 920$ MHz
$h_b = 49.22$ feet $= 15$ meters
$h_m = 6.56$ feet $= 2$ meters

Then:
$26.16 \log f = 77.53$
$13.82 \log h_b = 16.25$
$44.9 - 6.55 \log h_b = 37.20$

And:
$(1.1 \log f - 0.7)\, h_m = 5.12$
$(1.56 \log f - 0.8) = 3.82$

Therefore: $A_{hm} = 5.12 - 3.82 = 1.30$

And: $L = 69.55 + 77.53 - 16.25 + 37.20 \log R - 1.30$

Or: $L = 129.53 + 37.20 \log R$

2. Desired Signal Characteristics at AMR Mobile Receiver (910-920 MHz)

$C_{min} = -100$ dBm
$(C/I)_{min} = 10$ dB

Therefore: $I \leq -110$ dBm (i.e. only co-channel signals at or above -110 dBm would adversely impact the mobile receiver)

Where: C = Desired Signal in dBm at Mobile Receiver
I = Interfering Signal in dBm at Mobile Receiver

3. Signal Strength of Interfering Signal: A worst case occurs if all of the 30 Watts of the co-channel LMS interfering signal is within the AMR receiver's 200 kHz narrowband IF bandwidth, i.e.,

I_t = 30 W = 14.77 dBW = 44.77 dBm

Where: I_t = Transmitted Co-channel Interfering Signal into Mobile Receiver

4. A more representative scenario would be one wherein the 30 Watt co-channel LMS station is transmitting across a 6 MHz bandwidth. Then:

I_t = 30 W ($^{200\text{ kHz}}/_{6\text{ MHz}}$) = 1.0 Watt
or
I_t = 0 dBW = 30.0 dBm

5. Then based on C_{min} = -100 dBm, $(C/I)_{min}$ = 10 dB and I_t = 30.0 dBm:

I_t - L = I(max) = -110
30.0 - (129.53 + 37.20 log R) = -110
30.0 - 129.53 - 37.20 log R = -110
99.53 + 37.20 log R = 110
37.20 log R = 10.47
log R = 0.281
R = 1.91 km = 1.19 miles

6. Hence, a LMS co-channel station transmitting a 30 Watt signal at 15 meters height across 6 MHz of bandwidth could create harmful interference to AMR mobile receivers out to a distance of 1.2 miles.

7. If, however, the maximum ERP of the LMS co-channel station is reduced from 30 Watts to 10 Watts, then I_t = 0.333 Watts = 25.23 dBm and with C_{min} = -100 dBm and $(C/I)_{min}$ = 10 dB, the maximum interference distance R is reduced to only 1.42 km or 0.88 miles.

8. Were the co-channel station's ERP reduced to 10 Watts and the station's antenna height (h_m) reduced to 10 meters, then I_t = 25.23 dBm, h_m = 10 and with C_{min} = -100 dBm and $(C/I)_{min}$ = 10 dB, the maximum interference distance R is reduced to only 1.22 km or 0.756 miles.